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Draft A

Evaluation of Alternatives for the Interim Stabilization of the Hexone Tanks

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Submitted by: Bechtel Hanford, Inc.

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1.0 INTRODUCTION

This document presents the engineering evaluation for interim stabilization of the 276-S-141 and 276-S-142 hexone storage tanks located in the 200 West Area of the Hanford Site. The hexone tanks are managed as a *Resource Conservation and Recovery Act of 1976* (RCRA) treatment, storage, and disposal (TSD) facility and are regulated by the Washington State Department of Ecology (Ecology). In May 2000, Ecology issued a Notice of Correction (NOC) citing several findings concerning operation of the tank system. The NOC is included in Appendix A.

This evaluation will serve as a decision-making tool for use by Ecology. This engineering report identifies alternatives, cost estimates for implementing interim stabilization activities, schedule considerations, and key aspects of a conceptual closure plan. This report also serves to document the results of the sampling and analysis event.

1.1 PROBLEM DEFINITION/BACKGROUND

The hexone tanks are included in the 200-IS-1 Operable Unit of the Hanford Site. While awaiting alignment, characterization, and disposition of similar sites in the 200 area, the hexone tanks have been maintained as an out-of-service tank system. The hexone tanks have been safeguarded by a nitrogen purge almost continuously since 1992. This inert gas purge mitigates the risks associated with the hazardous vapors in the tanks. The purge prevents the collection of flammable vapor mixtures and eliminates the safety hazard to workers.

In April 2000, Ecology conducted an inspection of the TSD unit encompassing the tanks. In May 2000, Ecology issued an NOC regarding the current state of the hexone tanks. The NOC required that the hexone tanks be stabilized to remove all potential safety hazards to employees no later than December 2001. The NOC specified additional constraints. The stabilization must include removal or deactivation of the waste. If the tanks remain in-place, provision must be made for monitoring the tanks for oxygen/organic vapors and for intrusion of liquids.

Consistent with the letter of response to the NOC by the U.S. Department of Energy, Richland Operations Office, and Bechtel Hanford, Inc. (Appendix B), a number of actions are either completed or in progress, including the following:

- In September 2000, the *Data Quality Objective for 276-S-141/142 Hexone Tank Characterization/ Stabilization Project* (BHI 2000a) was issued. The data quality objective report outlined a sampling and analysis strategy to provide waste verification and designation data.

- In December 2000, the *Sampling and Analysis Plan for the 276-S-141/142 Hexone Tank Characterization/Stabilization Project* (DOE-RL 2000b) was issued. The sampling and analysis plan presented the planning strategy, procedures, and implementation of the sampling and analysis strategies in support of the stabilization of the hexone tanks.

- In March 2001, the sampling event was completed. This included a video survey of the tank internals.
  (Complete analytical results are expected to be available in May 2001.)

1.2 REPORT ORGANIZATION

This engineering report is organized as follows:

- Section 1.0 presents the purpose of the engineering report and the problem definition/background.
- Section 2.0 presents the objectives of the interim stabilization activities.
- Section 3.0 presents site background information, including process history, previous investigations, and remedial actions.
- Section 4.0 presents the results of the characterization investigation. The sample collection activities and analytical results are summarized, and the contaminants of concern are reviewed, focusing on the associated hazards and risks.
- Section 5.0 identifies the alternatives. The key aspects of each alternative are explained, along with qualitative criteria that are used to screen the alternatives.
- Section 6.0 presents the regulatory requirements governing the corrective action, along with any related standards or requirements that need to be considered.
- Section 7.0 presents the comparative analysis of the alternatives. The alternatives identified in Section 5.0 are evaluated against more specific criteria and compared.
- Section 8.0 presents the technical basis for and recommendation of the preferred alternative.
- Section 9.0 lists the references cited in this engineering report.
- Appendix A includes a copy of the NOC issued by Ecology, Appendix B contains a copy of the response to the NOC, and Appendix C contains cost estimating worksheets.

2.0 INTERIM STABILIZATION OBJECTIVE

Every remedial action plan must have clearly defined objectives. These objectives include identifying performance requirements, points of compliance, and acceptable time frames for implementation. Once the objectives are established, a valid comparison can be assessed.

Consistent with the NOC, the objective of this interim stabilization action for the hexone tanks is to remove all potential safety hazards to employees. The tanks need to be maintained in a safe and stable condition while they await final disposition consistent with closure activities associated with the 200-IS-1 Operable Unit.

The NOC requires that stabilization include removal or deactivation of the residual waste material. In addition, the NOC requires that if the tanks remain in-place, monitoring for organic vapors and for liquid intrusion must be addressed.

As stated in the letter of response to the NOC, the safety assessment (USQ Safety Evaluation, 0200W-US-N0144-02) confirms the effectiveness of the current system configuration as related to worker safety. To that end, the objective of additional interim stabilization includes increasing the level of confidence in safely maintaining the hexone tanks.

3.0 SITE BACKGROUND

3.1 SITE SETTING

The central plateau of the Hanford Site houses a number of facilities that formerly served to process irradiated nuclear fuel. Since the late 1980s, the mission at the Hanford Site has transitioned from plutonium production to environmental cleanup. The Reduction/Oxidation (REDOX) facility (202-S Building) was constructed between 1950 and 1952 in support of the Hanford Site's plutonium production mission.

The hexone tanks (276-S-141 and 276-S-142) are located in the southeast corner of the 200 West Area in the vicinity of the REDOX building. These are carbon steel tanks with a nominal capacity of 90,849 L (24,000 gal) each. The tanks are horizontal cylindrical with dished ends and shell dimensions of approximately 3.5 m (11.5 ft) diameter by 8.5 m (28 ft) length. The tops of the tanks are approximately 0.9 m (3 ft) below the soil surface.

3.2 PROCESS HISTORY

The REDOX facility was the first facility in which a continuous-flow, solvent-extraction process was used for the recovery of plutonium from irradiated fuel. The process was designed to separate individual product streams from associated fission products in the irradiated fuel. Processes were developed using different solvent mixtures. Hexone was used in the plutonium/uranium extraction process.

The storage tanks were installed in 1951 and were used until 1967 for storage of industrial-grade hexone. Before 1967, these tanks were not radiologically contaminated. In 1967 when the REDOX plant was shut down, the remaining radiologically contaminated solvent inventory within the nuclear fuel reprocessing system was pumped into the two underground storage tanks. Tank 276-S-141 received hexone distilled in the REDOX steam-stripping column. The 276-S-142 tank received some hexone and a mixture of kerosene and tributyl phosphate from the plant. Subsequently, the tanks were used to store these radioactively contaminated organic liquids.

In 1991, a remediation demonstration operation was completed. Pumpable liquids were removed from the tanks, distilled, and disposed. After completion of the distillation operation in 1992, each tank contained approximately 946 L (250 gal) of residual materials. This tar-like residue is believed to be distillation bottoms product containing tank-corrosion materials, tributyl phosphate, normal paraffin hydrocarbons (similar to kerosene), hexone, radionuclides, and water.

3.3 CURRENT CONFIGURATION

A RCRA Part A Permit Application for the hexone tanks was initially submitted to Ecology in December 1987, and most recently revised in 1994. A RCRA closure plan for the tanks was submitted in November 1992 (DOE-RL 1992). The tanks are regulated as dangerous waste tank TSD units with waste codes D001 (ignitability), F003 (listed spent solvent), and WT02 (toxicity criteria).

The tanks are vented with an approximate 2.0 ft^3/hr nitrogen purge per tank. The purge system includes Dewars of liquid nitrogen (as the source) and manual flow control on the inlet to each tank. The exhaust includes a high-efficiency particulate air (HEPA) filter and activated carbon filter. The area is fenced off as a controlled access zone.

3.4 ACCESS AND LAND USE

The TSD unit within which the hexone tanks are located is a fenced area with locked gate entry. Access is restricted to authorized personnel. Access to the 200 Areas and the central plateau in general is currently restricted. The Hanford Site is routinely patrolled by the Hanford Patrol or the Benton County sheriff. The land use, as consistent with the mission at the Hanford Site, is focused on waste management and cleanup activities. These institutional controls are anticipated to be maintained for the duration of the current mission.

4.0 CHARACTERIZATION OF HAZARDS

4.1 SAMPLE COLLECTION

Characterization of the tank and residual material was required to respond to some of Ecology's inspection findings. In order for a thorough evaluation to be made, sufficient data had to be collected to adequately define the affected media.

On March 2 through 7, 2001, the tanks were sampled. The sampling event included deploying the camera into the tanks through the 6-cm (24-in.)-diameter manway to guide the sampling effort and to visually survey the tank internals. Samples were collected through the 6-cm (24-in.)-diameter manway and the 10-cm (4-in.)-diameter riser

Results of chemical and radiological analyses will be used to support the efforts of designation and documentation of the residual material.
(Complete analytical results are expected to be available in May 2001.)

Data were collected by the sampling and analysis effort for the following purposes:

- Verification of the conceptual model for the tank contents
- Designation and documentation of the tank residual materials (in accordance with the requirements of *Washington Administrative Code* [WAC] 173-303)
- Support to this engineering evaluation as necessary to develop stabilization alternatives.

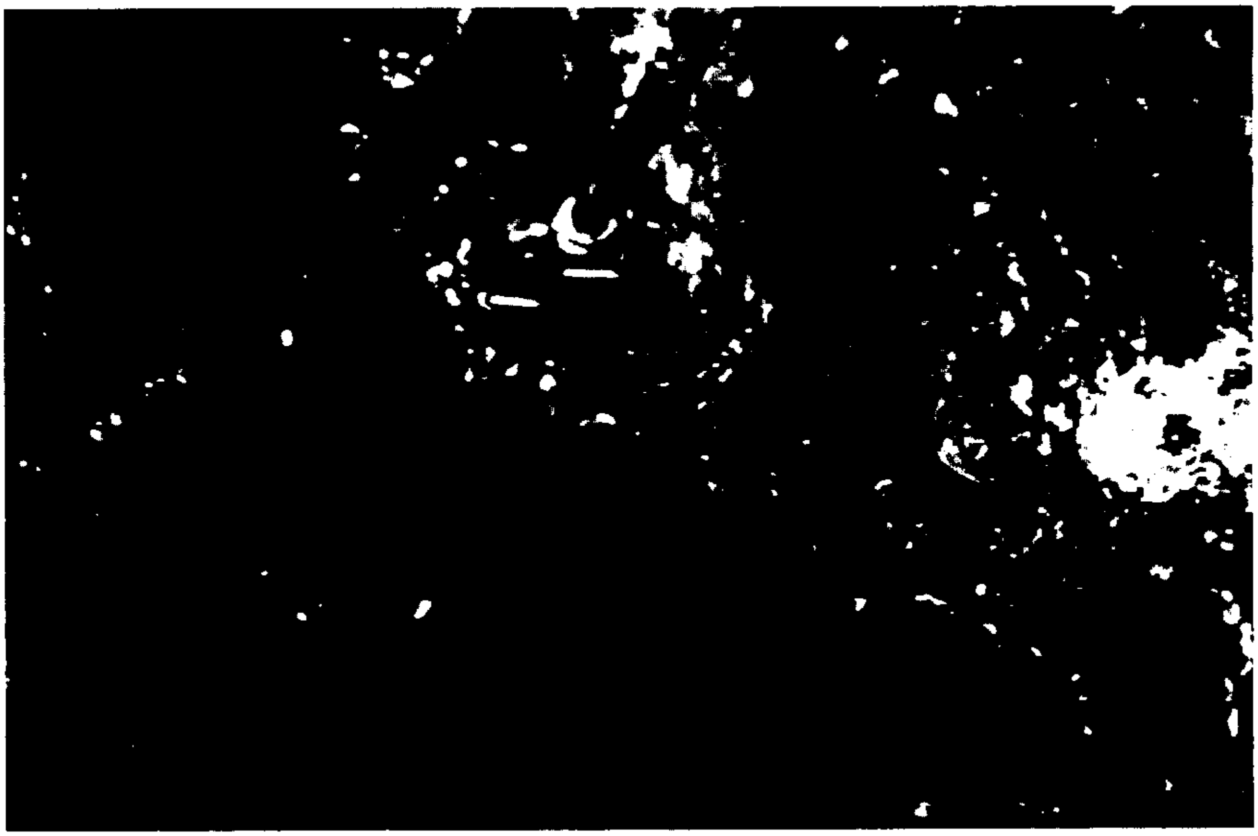
Photographs and still frames taken from the video tape of the tank internals are shown in Figures 1 through 3. These selected photographs highlight the residual waste material. Figures 1 and 2 show some residual waste material being transferred to sample containers. Figure 3 shows the material in the tank being scooped into the sampling tool. Of particular note is the apparent thick consistency of the material. In Figure 3, the material layer in the tank shows fissures from surface drying. The condition of the tank walls and interior surfaces is most clearly viewed on the videotapes (276-S-141 Tank Sampling, dated March 2-3, 2001 [VHS Tape]; 276-S-142 Tank Sampling, dated March 6-7, 2001 [VHS Tape]) More detail is provided in *Hexone Tanks 276-S-41 and 142, VHS Videotape Notes* (BHI 2001). (Still frames of the walls taken from the videotapes were of poor resolution and therefore are not included in this report.)

Video survey of the tanks' internals was conducted on March 2 and March 6, 2001. The survey showed that the volume of residual material in the tanks was on the low end of the anticipated range. No ponding of liquid was observed in the tank. The sludge appeared as a uniform tar-like layer across the bottom extending the length of the tank with a dried cracked crust surface. The depth appeared to be approximately equal to the 8.25 cm (3.25 in.) diameter of the sample tool (beaker).

Figure 1. Collecting Sample from Tank 276-S-142.

Figure 2. Collecting Sample from Tank 276-S-141.

Figure 3. Sludge in Tank 276-S-142 - Surface Condition.



This is consistent with the model as presented in the data quality objectives report and the sampling and analysis plan (BHI 2000a, DOE-RL 2000b).

The video survey indicated that each tank is structurally sound. The tanks' internal surfaces appeared rusted but with no apparent pits or voids. There was no evidence to suggest that either tank is leaking; however, no soil samples from around the tanks were taken.

4.2 ANALYTICAL RESULTS

Partial preliminary results are presented in Tables 1 through 3.

(Final result will be incorporated into the final revision.)

The analytical results indicate that radionuclide constituents are below the transuranic concentration level of 100 nCi/g.

4.3 HAZARDS AND SAFETY EVALUATION

4.3.1 Identification of Contaminants of Concern

Contaminants of concern (COCs) are defined as those chemicals specified, within the environmental regulations, to be potentially threatening to the environment or human health. A COC becomes a contaminant when the COC occurs at a concentration that poses an unacceptable threat to the environment and/or to human health. Table 4 lists the COCs for the hexone tanks.

The residual sludge is presently confined and therefore is limited in pathways of migration to the environment. In this situation, the metals, inorganics, and radionuclides are less mobile than the organics. Some of the organics, the volatile and semi-volatile compounds, are easily mobile in the vapor phase. This is the most significant risk within the tank system as currently configured. However, the purge system is engineered to address the hazards associated with the vapor phase.

4.3.2 Safety Evaluation

Safety evaluation and hazard analyses are risk assessment tools for evaluating the potential threats to the environment and/or to human health resulting from potential hazards. These tools are used in the decision-making process to yield prudent, technically sound decisions that protect the environment and human health in a cost-effective manner.

Table 1. 276-S Hexone Tank Sludge – Tank 141 Sludge Sample Preliminary Results. (2 Pages)

Contaminant of Concern	West Composite Sample (B11D03/D08)	West Replicate Sample (B11D04/D09)	East Sample (B11D05/D11)
Total Metals (µg/g)			
Arsenic			
Barium			
Cadmium			
Chromium			
Lead			
Mercury			
Selenium			
Silver			
Iron			
Phosphorus			
Potassium			
Sodium			
Uranium	51	48	9.6
TCLP Metals (µg/L)			
Arsenic			
Barium			
Cadmium			
Chromium			
Lead			
Mercury			
Selenium			
Silver			
Anions (µg/g)			
Fluoride			
Chloride			
Nitrite			
Nitrate			
Phosphate			
Sulfate			
Cyanide			

Table 1. 276-S Hexone Tank Sludge – Tank 141 Sludge Sample Preliminary Results. (2 Pages)

Contaminant of Concern	West Composite Sample (B11D03/D08)	West Replicate Sample (B11D04/D09)	East Sample (B11D05/D11)
Volatile Organics (μg/g)			
Acetone			
Hexone			
Semi-Volatile Organics (μg/g)			
Aroclor 1254	7.2	7.1	3.3
Tributyl phosphate			
Normal paraffin hydrocarbon			
Radionuclides (pCi/g)			
Hydrogen-3	650	781	1600
Carbon-14	104	75	89
Cobalt-60	0.59 U	0.65 U	0.24 U
Total Strontium	1,330	1,020	1,220
Technetium-99	11 U	11 U	4.2 U
Antimony-125	8.0	8.6	2.4
Cesium-137	74	64	115
Europium-154	194	182	38
Europium-155	53	45	8.3
Uranium-233	15	16	9.6 U
Uranium-235	11 U	12 U	12 U
Uranium-238	8.4	14	9.6 U
Plutonium-238	2,210	2,520	1,260
Plutonium-239/240	3,100	3,610	1,320
Americium-241	6,830	7,210	2,780
Curium-244	579	390	135
Other Analytes			
Total organic carbon			
pH (units)			

J = Parameter detected below the reporting limit
NA = Parameter not analyzed
TCLP = Toxic characteristic leachate procedure
U = Parameter not detected above the reported limit

Table 2. 276-S Hexone Tank Sludge – Tank 142 Sludge Sample Preliminary Results. (2 Pages)

Contaminant of Concern	West Composite Sample (B11D06/D15)	East Sample (B11D07/D14)	Equipment Blank (B11CX1)	Equipment Blank (B11CX2)
Total Metals (µg/g)				
Arsenic				
Barium				
Cadmium				
Chromium				
Lead				
Mercury				
Selenium				
Silver				
Iron				
Phosphorus				
Potassium				
Sodium				
Uranium	87	296	NA	NA
TCLP Metals (µg/L)				
Arsenic				
Barium				
Cadmium				
Chromium				
Lead				
Mercury				
Selenium				
Silver				
Anions (µg/g)				
Fluoride				
Chloride				
Nitrite				
Nitrate				
Phosphate				
Sulfate				
Cyanide				

Table 2. 276-S Hexone Tank Sludge – Tank 142 Sludge Sample Preliminary Results. (2 Pages)

Contaminant of Concern	West Composite Sample (B11D06/D15)	East Sample (B11D07/D14)	Equipment Blank (B11CX1)	Equipment Blank (B11CX2)
Volatile Organics (μg/g)				
Acetone				
Hexone				
Semi-volatile Organics (μg/g)				
Aroclor 1254	4.4	1.4		
Tributyl phosphate				
Normal paraffin hydrocarbon				
Radionuclides (pCi/g)				
Hydrogen-3	467	581	0.16 U	0.16 U
Carbon-14	84	85	0.046 U	0.044 U
Cobalt-60	1.0	2.1 U	0.016 U	0.008 U
Total Strontium	9,020	21,600	0.00050 U	0.00050U
Techtetium-99	15 U	49 U	0.011 U	0.012 U
Antimony-125	38	113	NA	NA
Cesium-137	1,040	1,060	0.0015 U	0.0008 U
Europium-154	379	874	0.052 U	0.028 U
Europium-155	75	186	0.021 U	0.021 U
Uranium-233	31	74	0.000026 U	0.000023 U
Uranium-235	11 U	36 U	0.000025 U	0.000022 U
Uranium-238	29	78	0.000021 U	0.000018 U
Plutonium-238	8,000	10,100	0.00024 U	0.00019 U
Plutonium-239/240	9,960	14,600	0.00024 U	0.00019 U
Americium-241	26,000	36,100	0.00024 U	0.00029 U
Curium-244	1,970	2,090	0.00030 U	0.00029 U
Other Analytes				
Total organic carbon				
pH (units)				

J = Parameter detected below the reporting limit
NA = Parameter not analyzed
TCLP = Toxic characteristic leachate procedure
U = Parameter not detected above the reported limit

Table 3. 276-S Hexone Tank Sludge Samples.

Contaminant of Concern	West Sample (B11D08)	Middle Sample (B11D10)	East Sample (B11D11)	North Sample (B11D12)	South Sample (B11D13)
Tank 141 Sludge TRU Preliminary Results					
TRU Radionuclides (pCi/g)					
Plutonium-238	2,210	2,910	1,260	4,280	3,460
Plutonium-239/240	3,100	3,590	1,320	5,820	4,100
Americium-241	6,830	5,980	2,780	9,770	10,800
Curium-244	579	279	135	750	535
TRU Calculations (nCi/g)					
Total TRU	12.7	12.8	5.5	20.6	18.9
Number of Samples	5				
Average TRU	14.1				
Standard Deviation	5.4				
Z-statistic	1.6				
95% UCL[a]	18.0				
Tank 142 Sludge TRU Preliminary Results					
TRU Radionuclides (pCi/g)					
Plutonium-238	8,000	9,160	10,100	10,000	13,600
Plutonium-239/240	9,960	11,400	14,600	13,200	19,800
Americium-241	26,000	21,500	36,100	34,400	47,600
Curium-244	1,970	1,360	2,090	1,370	2,390
TRU Calculations (nCi/g)					
Total TRU	45.9	43.4	62.9	59.0	83.4
Number of Samples	5				
Average TRU	58.9				
Standard Deviation	14.3				
Z-statistic	1.6				
95% UCL[a]	69.4				

[a]*Remedial Design Report/Remedial Action Work Plan for the 100 Area*, Rev. 2, Appendix G, DOE/RL-96-17 (DOE-RL 2000a).
TRU = transuranic
UCL = upper confidence limit

Table 4. List of Contaminants of Concern.

Radionuclides		
Americium-241 Curium-244 Carbon-14 Cesium-137 Cobalt-60 Europium-152	Europium-154 Europium-155 Hydrogen-3 Plutonium-238 Plutonium-239/240	Total radioactive strontium Technetium-99 Uranium-234 Uranium-235 Uranium-238
Chemicals		
Organics		
n-Butyl alcohol Kerosene (paraffin hydrocarbons) 2-propanone (acetone)	2-butanone 4-methyl-2-pentanone (hexone) 2-hexanone	Tributyl phosphate Polychlorinated biphenyls
Inorganics		
Cyanide Phosphate Sulfate	Nitrate Nitrite	Chloride Sulfides
Metals		
Mercury (total and TCLP) Lead (total and TCLP) Nickel Silver (total and TCLP) Antimony	Arsenic (total and TCLP) Barium (total and TCLP) Beryllium Cadmium (total and TCLP) Chromium (total and TCLP)	Copper Selenium (total and TCLP) Uranium (total)

TCLP = toxic characteristic leachate procedure

Source: *Sampling and Analysis Plan for the 276-S-141/142 Hexone Tank Stabilization/Characterization Project*, DOE/RL-2000-73 (DOE-RL 2000b).

Applicable hazard analysis and safety requirements for the 276-S-141 and 276-S-142 hexone tanks are documented in the approved facility safety analysis report and technical safety requirements (BHI 2000c). The facility safety requirements that comply with 10 *Code of Federal Regulations* (CFR) 830, "Nuclear Safety Management," Subpart B, "Safety Basis Requirements", are applicable to the current status of the hexone tanks.
Sample analysis data from the residual wastes will be verified to be consistent with the hazard analysis and therefore will confirm the validity of the facility safety analysis report and technical safety requirements.

Modification to the hexone tank and appendent systems (i.e., alternatives 1, 2-2, 2-3, or tank removal) requires additional safety evaluation to determine the impacts to the existing safety analysis and technical safety requirements.

The current safety analysis defines a combustion event as the worst-case release event that could threaten workers or the localized environment. The worst-case combustion event was postulated to be a deflagration. Postulated dose consequences, both chemical and radiological, were found to be relatively minor. Potential missile generation was also found to be of a minor nature.

Of particular note, the Design Basis for Nitrogen System of the Hexone Tanks 276-S-141 and 276-S-142 (BHI 2000b) indicates that under the static or inactive status, it would take more than 600 days of ambient tank breathing for the oxygen level to rise sufficiently to support combustion. This considers that the purge gas is stopped when the tank oxygen level is about 3% and the tank "breathes" via average daily barometric fluctuations until the oxygen level rises to 11%. Testing indicates that the nitrogen system has maintained oxygen concentration at less than 2%.

The facility safety evaluation concluded that three relatively simple controls provide defense-in-depth to minimize risks:

- Minimize the threat of ignition source. Open flames and smoking are prohibited within 6 m (20 ft) of the fenced area.
- Maintain oxygen concentrations less than 11% to prevent combustion of hexone vapors. An operational safety margin has been established to 6.6% for the system configuration consistent with fire protection standards (NFPA 69).
- Maintain access restrictions by fencing and administrative procedures to ensure that ignition sources are not inadvertently introduced and to ensure that appropriate work controls are applied in the immediate area of the hexone tanks.

5.0 IDENTIFICATION OF ALTERNATIVES

Engineering feasibility studies are commonly performed to develop and evaluate alternative remedies. The criteria that were used to qualify technologies for further development are presented in this section. The resulting alternatives are evaluated in Section 7.0.

Consistent with the requirements in the NOC (and as presented in Section 2.0 of this report), the overall objective of this interim stabilization action is to remove the potential safety hazard to workers associated with the hexone tanks.

The safety hazard is attributable to the organic compounds in the residual sludge in the tanks. As previously described, the residual material is confined within the shell of the underground storage tanks. Because there is no visual indication from within the tanks that the tanks are leaking, institutional controls are appropriate for safeguarding the solid-phase material. Therefore, safety concerns are limited to those involving the vapor phase.

Potential remedies are qualified by the following criteria:

- Minimizes the hazard to the extent necessary to protect site workers
- Approach must be straightforward
- Must be suitable for implementation by December 2001
- Does not prevent future closure of the tank system
- Does not contribute to the potential migration of contamination
- Minimizes the need for maintenance.

This initial screening yields the most appropriate approach for addressing the hazard as identified. Control of the hazard can be addressed by (1) inhibiting vapor formation, (2) collecting and treating the vapors, or (3) removing the source material.

Two alternatives that address these control technologies are as follows:

1. Stabilize by void fill: The formation of vapor is inhibited.
2. Continue with the nitrogen purge: The current purge system collects and treats the vapor.

Removal of residue from the tank or mixing in the tank, in-place, is judged to be not possible considering commercially available technology. Some commercially available "deactivating" agents were reviewed; all required intimate mixing of the reagent with the waste material, and therefore were not considered further. Because the consistency of the residual waste material is thick, sticky, and tar-like, any treatment or action that would require physical manipulation of the residual material is considered to be impractical and unacceptable. This disqualifies any method of treatment that requires mixing of a reagent with the waste material.

In addition to these above-listed alternatives, a scenario is constructed that involves aspects of a tank removal action. This is for comparison only. No alternative is developed for the removal of source material, because screening criteria could not be met. An action plan could not be developed and implemented by December 2001.

5.1 ALTERNATIVE 1: VOID FILL

This alternative consists of eliminating the void space in the tank where vapor collects. The void is filled with a suitable inert material, which sets to the shape of the tank. This inhibits the vaporization of the residual waste in the tank and eliminates the potential for accumulation of vapors, which could otherwise lead to a hazard.

The purge system would no longer be needed. The above-ground piping and equipment could be removed, including the nitrogen supply, the HEPA filter, and the carbon filters. Ongoing maintenance of active equipment would not be required. There would be no need for monitoring of liquid intrusion, and the TSD area would remain fenced. This alternative is passively safe.

The video survey of the tanks' internals shows no visual evidence to suggest leaks. Because the tank would be filled, there would be no concern for intrusion of liquids or collection of hazardous vapors. The residue in the tanks is a gelatinous mass of low fluidity; it would remain sealed in the tank. This would not preclude any future remedial action. Impact from this alternative on possible future action would include the disposal of the additional waste created by the filler material. The tanks would be cut open to remove the waste whether void filled or not. The surface of the fill material at the interface with the waste would be mechanically cleaned as would the tanks interior surfaces. No other impacts are identified.

The following criteria were considered in selecting the fill material. The filler must be able to meet the following:

- Be chemically nonreactive with the residual waste material
- Be commercially available
- Provide long-term stability and
- Be easily poured (self-leveling)
- Not preclude removal of waste required for final RCRA closure of the tank.

The filler materials that were reviewed include Portland cement (grout), sand, clay, lime, epoxy/polymer, and bitumen. All are commercial products; the cement, sand, and lime are most easily available. The cement, sand, clay, and lime are reasonably inexpensive.

Portland cement-based mixtures are very widely used in solidification of hazardous and mixed wastes. In this respect, it is proven to be stable, easy to use, and amenable to varying waste composition. The composition of a grout mixture can be modified to address varying requirements in physical properties. The cured matrix is relatively low permeability and moderate to high compressive strength.

Sand is used as a void filler in abandoned petroleum storage tanks. It is chemically stable and nonreactive. It can be the least expensive of these reviewed materials. Sand does not cure and remains particularly permeable. Over time, a small amount of settling can occur.

Clay is compatible with the subject wastes and is chemically stable over time. When mixed in water, the slurry is very workable. In untreated form, it can dry and shrink, thereby reducing the integrity of the matrix. Treated clays are available that modify such properties, but at a greater cost. Experimentation may be required to determine the specific clay-to-water ratio.

Lime can be used as a base for grout, similar to Portland cement. However, the cured matrix exhibits lower strength. It is compatible with the wastes and chemically stable. It is not traditionally used by itself in such application; more commonly, it is an additive to Portland cement to modify workability.

Epoxy and polymer binders have been used in solidification of radioactive waste. The high performance capability of this matrix exceeds the level needed for this application. The cost would be notably greater than any other material considered.

Bitumen is an asphalt-based material. Its permeability, stability, and compatibility are suited to this application. However, it would need to be heated in order to be workable and its cost is not competitive.

This qualitative review indicates that Portland cement-based grout is the filler of choice. The Portland cement is commercially available, stable over the long term, and easily applied. The level of chemical reactivity with the residual waste material is not a concern. Void fill of the tanks with grout will not preclude future closure actions. The alternative of void fill is developed further with cement grout as the fill material.

Work activities considered in the development of this alternative include the following:

- Provide project management and field support management
- Prepare engineering documents
- Procure materials
- Mobilize to site
- Modify system/remove piping and components as necessary
- Pour grout into tanks
- Demobilize.

Materials (grout fill) and waste disposal (removed piping) are additional costs considered in the comparison.

5.2 ALTERNATIVE 2: CONTINUE WITH THE NITROGEN PURGE

This alternative considers the continued use of the nitrogen purge system and includes three suboptions. Alternatives based on the continued use of the purge system are considered primarily for a possible savings in surveillance and maintenance costs. The existing safety evaluation confirms the adequacy and effectiveness of the system's current configuration as related to worker safety.

The first suboption considers the continued use of the nitrogen purge system in its current configuration and maintaining the daily surveillance of the equipment and process. The purge system is designed to maintain an inert atmosphere inside the tanks to preclude an ignitable vapor mixture. The daily inspection serves to ensure proper flow of nitrogen, verifies adequate supply and reserve (liquid nitrogen), and provides for observation of general site conditions (guards against degradation of equipment, which might introduce a safety hazard). The exhaust from the purge is routed through a HEPA filter and carbon filters for radiological and volatile organic contaminant emissions, respectively.

The following are considered in developing a comparative cost:

- Daily surveillance of system operation
- Maintenance of system components

- Supply of nitrogen
- Periodic replacement of filters.

The second suboption considers the continued use of the nitrogen purge system with some modification to the configuration as needed to extend reliability. Continued surveillance activities would be required, although at an extended interval. Periodic inspections would be conducted. The nitrogen supply would require renewal at the same rate as the current operation (twice per week). The extended reliability would be provided by remote annunciation of nitrogen flow abnormalities. The pressure and flow of the nitrogen stream would be monitored by sensors with high and low set-points. Remote alarms would be located in the control room at the 271-U Building. These would actuate if the nitrogen flow were outside of the acceptable range. The instrumentation would require periodic calibration and maintenance.

Work activities considered in the development of this alternative include the following:

- Provide project management and field support management
- Prepare engineering documents
- Procure materials
- Install hardware/modify system
- Startup/test/integrate new components.

In addition, the following are considered in developing a comparative cost:

- Periodic surveillance of system operation
- Maintenance of system components
- Supply of nitrogen
- Periodic replacement of filters.

The third suboption considers the intermittent use of the nitrogen purge system with notable modification to the mode of operation. This option relies on analyses performed as part of the safety evaluation. The Design Basis for Nitrogen System of the Hexone Tanks 276-S-141 and 276-S-142 (BHI 2000b) indicates the capacity for the system, as configured, to maintain a nonignitable vapor mixture for an extended period (over 600 days). This option would retain the purge system hardware in its current configuration but would discontinue the steady flow of purge gas. The interval for surveillance and maintenance activities would be extended to 6 months. At that interval, the oxygen level in the tank would be checked and adjusted, if necessary, to below 3% by starting the flow of purge gas. Monitoring for potential intrusion of liquid would be addressed by use of a video camera deployed in a similar manner to the recent tank entry event. The recent video survey of the tank interior indicated that each tank is structurally sound. There was no evidence to suggest that either tank is leaking. From this, engineering judgement suggests that an interval of 5 years is suitable for interim interior surveillance.

Work activities considered in the development of this option are similar as above.

5.3 KEY ASPECTS OF TANK REMOVAL

This scenario addresses some aspects associated with removal of the hexone tanks as part of a clean closure. This is presented for comparison only and is not developed to the level of the alternatives.

Removal of the tank with contained residual waste material would eliminate the source of the vapor and its safety hazards. However, performing these actions in isolation from the closure strategy for the overall 200 Areas would be inefficient and might introduce unjustifiable risks in consideration of as low as reasonably achievable (ALARA) principles. Whenever the residual waste material would be handled, there is a potential for exposure. Also, this scenario would be more expensive and could not be achieved by December 2001.

Preparatory work would include permitting the removal action, coordinating waste disposal, planning the work activities, engineering the tasks and tools, and mobilizing to the site. Approximately 1,299 m^3 (1,700 yd^3) of soil would be excavated from the site. A sampling and analysis instruction would address characterization of the soil under the tanks. Remediation of contaminated soil, if any, would be postponed until final closure action of the site. The tanks would be removed by crane from the excavation and set down in a prepared area nearby. The tanks would be maintained with an inert gas atmosphere during these activities. A large-scale "glovebag" would be built around the two tanks to control potential emissions when cutting into the tanks. The tanks would be cut open to remove the residual waste material. The waste would be packaged for transfer to the Central Waste Complex and then to the final treatment facility. The tanks would be cut and packaged for shipment to a disposal facility. Once the waste and tanks were shipped, the site and work area would be demobilized.

Work activities considered in the development of this scenario include the following:

- Coordinate regulatory permits for tank removal
- Provide project management and field support management
- Prepare engineering documents (i.e., design package, task instruction)
- Prepare sampling plan (e.g., sampling and analysis instruction)
- Conduct safety evaluation, authorization basis impacts, unreviewed safety question screen
- Waste management coordination
- Conduct pre-job safety walkdown and review (job hazard analysis process)
- Mobilize to site
- Excavate soil
- Remove tanks
- Sample soil under tank (necessary to characterize soil for subsequent action)
- Transport the inerted tank to a prepared site where it will be cut, cleaned, and scrapped
- Build walk-in glovebag around the two tanks
- Scoop out residual waste material from tank shell section
- Transfer residue to approved containers
- Package the scrapped tank

- Transport the respective waste containers to the appropriate disposal facilities
- Demobilize
- Other
  - Waste disposal fees
  - Procure miscellaneous supplies and materials, as needed.

6.0 IDENTIFICATION OF STANDARDS AND REQUIREMENTS

6.1 WASTE MANAGEMENT

RCRA and the state dangerous waste program establish various requirements for identifying and managing dangerous waste. Underground storage tank requirements are codified in 40 CFR Subpart J for both disposition and management until approved closure occurs.

Federal regulations pertaining to hazardous wastes are identified in 40 CFR 260 through 270. Washington State regulations in WAC 173-303 define designation of dangerous wastes (WAC 173-303–070), performance standards (WAC 173-303–283), general waste analysis in (WAC 173-303-300), and other general requirements for underground storage tanks.

Specific standards pertaining to operation and closure of RCRA dangerous waste tank systems (such as the hexone tanks) are established in WAC 173-303-640 and WAC 173-303–610.

The *Toxic Substances Control Act of 1976* regulates the management of polychlorinated biphenyls. Regulations are codified in 40 CFR 761.

6.2 AIRBORNE EMISSIONS

The *Clean Air Act* regulates both chemical and radioactive airborne emissions. Increases in any regulated emission would require evaluation and implementation of suitable controls. These regulations are codified in 40 CFR 61, WAC 246-247, and WAC 173-400 (Federal and state, accordingly).

6.3 RADIONUCLIDE EMISSIONS

To permit radionuclide emissions that could potentially be released during interim stabilization, activities are managed under WAC 246-247. The project must demonstrate using the U.S. Environmental Protection Agency-approved CAP-88C modeling program to calculate a potential to emit unabated radiological dose to an off-site receptor and a worker at the Laser Inferometer Gravitational Observatory. The calculated dose is expected to be that the emission will be less than 0.1 mrem/yr. If emissions during the interim stabilization are to be controlled with an active ventilation system (e.g., glovebox ventilated through a HEPA vacuum), then the

Hanford Site-wide portable temporary radionuclide air emission unit Notice of Construction must be used (DOE-RL 1996, 1999).

6.4 NONRADIONUCLIDE EMISSIONS

Requirements for nonradionuclide emissions are contained in two different sets of regulations, WAC 173-400-110 and WAC 173-460-040. WAC 173-400-110 Subsection (4) identifies categories of emission units that are exempt form the new source review.

WAC 173-460-040 requires new sources of emission units to obtain an Notice of Construction unless the following condition is met: The owner or operator of a new toxic air pollutant source listed in WAC 173-460-030 (1) is not required to notify or file a notice of construction with Ecology if the new source is a minor process change that does not increase capacity and total toxic air pollutant emissions do not exceed the emissions rates specified in small quantity emission rate tables in WAC 173-460-080. An evaluation of the small quantity emission rates during stabilization could be required based on the new sampling data that are forthcoming from the laboratory.

6.5 WORKER PROTECTION

Worker protection standards are described in the Occupational Safety and Health Administration regulations.

Personnel protection from radiation is addressed by federal regulations (10 CFR 835). Standards, limits, and program requirements are mandated as well as adherence to ALARA principles.

7.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

Although the actions under consideration would not be done under *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) authority, criteria from the CERCLA process, with modification, were adapted for purposes of evaluating the different alternatives. Specific evaluation criteria selected were protection of human health and the environment, short-term protectiveness, long-term protectiveness, implementability, and cost.

7.1 PROTECTION OF HEALTH AND ENVIRONMENT

This criterion considers whether the alternative achieves adequate control of the risk to worker safety that is presented by the identified hazards. All alternatives considered achieve the objective of protecting worker safety and health by eliminating the flammability hazard.

7.2 EFFECTIVENESS

7.2.1 Short-Term Effectiveness

This criterion considers the risk to workers and the public during implementation and the time for completing the alternative. The effectiveness in the near term is similar for the three alternatives. All alternatives could be done in a manner that ensures protection of workers during the implementation phase, although the void fill alternative would present more potential hazard since the work would involve opening the tank system. On completion of the tasks involved with implementation, the protection to worker safety is effective immediately. For the void fill alternative, the mode of the risk reduction becomes passive. There would be no active system to provide that level of protection. All alternatives could be complete by December 2001.

7.2.2 Long-Term Effectiveness

The long-term effectiveness criterion considers whether the alternative leaves an unacceptable risk over an extended time period. All these alternatives are effective in the long term and specifically do not preclude any further actions that may be required in the future.

7.3 IMPLEMENTABILITY

This criterion is a qualitative measure of the complexity involved with completing the tasks specified in the alternative. All alternatives are straightforward in approach. The continued purge alternative 2-1 is consistent with the current conditions (operations and system configuration). Alternative 2-3 is consistent with the current configuration of system equipment. Alternatives 1 and 2-2 each require some preparatory work of equal complexity.

7.4 COST CONSIDERATIONS

The economic feasibility of any remedial alternative must be considered. The cost is frequently a heavily weighted factor in determining its applicability and implementation. An alternative must be reasonably cost effective to warrant further evaluation.

Appendix C provides information used to develop site-specific cost estimates and provides a range of costs that can be expected for these alternatives. The cost estimates shown in Tables C-1 through C-5 were developed based on information from a number of sources, including recent experience of related tasks.

It should be noted that the cost estimates developed here are at what would typically be considered an order-of-magnitude level. The accuracy of the estimates is subject to substantial variation because the specific details of the designs will not be known until actually implemented. As a result, actual costs will likely vary from these estimates. The costs for the tank removal scenario are not developed to the level of the alternatives due to issues of uncertainty. Cost comparisons for each alternative are shown in Table 5.

Table 5. Comparison of Costs for Alternatives.

Alternative	Annual O&M Costs	O&M Costs for 10 Years	One-Time Costs	Total Cost
1	N/A	N/A	$94,724	$94,724
2-1	$58,564	$585,640	N/A	$585,640
2-2	$30,720	$307,200	$78,828	$386,028
2-3	$13,962	$139,620	N/A	$139,620
Tank Removal	N/A	N/A	[a]	[a]

[a]The costs associated with tank removal are incomplete. Those activities that have been estimated yield a subtotal of $182,692.
N/A = not applicable
O&M = operations and maintenance

8.0 PREFERRED ALTERNATIVE

The hexone storage tanks are considered a RCRA site awaiting integration into a larger closure strategy. At this time, much uncertainty is related to long-term planning. Any current actions must not adversely impact such plans.

Each alternative diminishes the hazards associated with the vapors from the waste. Also, each alternative allows for future actions that might be specified as related to the closure of the tank system and characterization of the central plateau. The alternative of void fill has the added benefit of being passive in nature and, on this basis, is judged to be the technically preferred alternative.

9.0 REFERENCES

10 CFR 830, "Nuclear Safety Management," *Code of Federal Regulations*, as amended.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.

BHI, 2000a, *Data Quality Objective for 276-S-141/142 Hexone Tank Characterization/ Stabilization Project*, BHI-01418, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *Design Basis for Nitrogen System of the Hexone Tanks 276-S-141 and 276-S-142*, 0200W-DB-G0003, Rev. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000c, *REDOX Facility Safety and Analysis Report*, BHI-01142, Rev. 2, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001, *Hexone Tanks 276-S-141 and 142, VHS Videotape Notes*, CCN 088368, Interoffice Memorandum from R. G. Egge, dated April 3, 2001, Bechtel Hanford, Inc., Richland, Washington.

Clean Air Act of 1955, 42 U.S.C. 7401, et seq.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 U.S.C. 9601, et seq.

DOE-RL, 1992, *Hexone Storage and Treatment Facility Closure Plan*, DOE/RL-92-40, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996, *Radioactive Air Emissions Notice of Construction Portable/Temporary Radioactive Air Emission Units*, DOE/RL-96-75, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 199, *Radioactive Air Emissions Notice of Construction for HEPA Filtered Vacuum Radioactive Air Emission Units*, DOE/RL-97-50, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000a, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2000b, *Sampling and Analysis Plan for the 276-S-141/142 Hexone Tank Stabilization/Characterization Project*, DOE/RL-2000-73, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 2000, *Notice of Correction for Stabilization of Hexone Storage and Treatment Facility, BHI Docket Number 00NWPKM006*, CCN 079387, letter from R. Wilson to K. Klein, U.S. Department of Energy, Richland Operations Office, and M. C. Hughes, Bechtel Hanford, Inc., dated May 26, 2000, Washington State Department of Ecology, Olympia, Washington.

NFPA 69, Standard on Explosion Prevention Systems, National Fire Protection Association, Quincy, Massachusetts.

Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.

Toxic Substances Control Act of 1976, 15 U.S.C. 2601, et seq.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 173-400, "General Regulations for Air Pollution Sources," *Washington Administrative Code*, as amended.

WAC 173-460, "Controls for New Sources of Toxic Air Pollutants," *Washington Administrative Code*, as amended.

WAC 246-247, "Radiation Protection – Air Emissions," *Washington Administrative Code*, as amended.

APPENDIX A

NOTICE OF CORRECTION ISSUED BY THE WASHINGTON STATE DEPARTMENT OF ECOLOGY

079387

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
1315 W. 4th Avenue • Kennewick, Washington 99336-6018 • (509) 735-7581

May 26, 2000

Mr. Keith Klein
U.S. Department of Energy
P.O. Box 550, MSIN: A7-50
Richland, Washington 99352

RECEIVED
MAY 3 1 2000
BY DIS

Mr. Michael C. Hughes
Bechtel Hanford, Incorporated
2250 George Washington Way, MSIN: H0-09
Richland, Washington 99352

Re: Notice of Correction for Stabilization of the Hexone Storage and Treatment Facility BHI DOCKET NUMBER 00NWPKM006

Dear Messrs. Klein and Hughes:

On April 25, 2000, the Washington State Department of Ecology (Ecology) conducted an inspection of the Hexone Storage and Treatment Facility (HSTF). The HSTF has been managed by the U.S. Department of Energy (USDOE) and Bechtel Hanford, Incorporated (BHI) as an unfit-for-use tank system per Federal Code of Federal Regulations (CFR), 40 CFR 265.196. However, Ecology's inspection revealed that the HSTF has not been removed from service as required by 40 CFR 265.196, and has not been managed in accordance with formal agreements made with Ecology as documented in Close Out Form #16.6.2: 40.16, signed by USDOE on December 6, 1996. Furthermore, the HSTF currently poses a safety hazard to employees as the tanks contain potentially reactive and explosive dangerous waste. The HSTF is inadequately inspected to ensure the HSTF is managed safely and the waste within the HSTF tanks remain inadequately designated per Washington Administrative Code (WAC) 173-303, Dangerous Waste Regulations.

Therefore, for the reasons stated above, Ecology herein rescinds its agreement with the provisions of Close Out Form #16.6.2: 40.16. In its place, Ecology will require the HSTF be managed per the requirements set forth in this letter. Furthermore, Ecology will require that the HSTF tanks be stabilized to remove all potential safety hazards to employees no later than December 2001. Ecology will also require increased surveillance and monitoring of the HSTF until stabilization in 2001 is achieved as described in this notice of correction letter.

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Ecology's April 25, 2000, inspection revealed the following findings:

- Maintenance of an inert atmosphere (nitrogen purge) within the HSTF tanks is poorly inspected and maintained.
- Dangerous waste stored within the HSTF tanks pose a safety hazard to workers in the area, are inadequately designated per WAC 173-303-070, and are not monitored for leaks or releases to the environment.
- Other than an outdated 1992 closure plan, no activity to remove the HSTF from service and close the HSTF tanks is in place.

As a result of Ecology's April 25th inspection, USDOE and BHI have committed the following violation:

VIOLATION:

#1) 40 CFR, Subpart J, section 265.196, Response to leaks or spills and disposition of leaking or unfit-for-use tank systems.

USDOE and BHI failed to immediately remove the hexone tanks from service per 40 CFR, Subpart J, section 265.196 or close the hexone tanks per 40 CFR, Subpart J, 265.196(e), and by reference of this regulation, 40 CFR 265.197.

On September 9, 1996, Ecology signed Close Out Form #16.6.2:40.16 with USDOE which identified the hexone tanks (hexone storage and treatment facility or HSTF) as an unfit-for-use tank system subject to the requirements of 40 CFR 265.196, disposition of unfit-for-use tank systems. This Close Out Form included the following actions to ensure protection of human health and the environment: (1) use had ceased, (2) waste had been removed sufficient for protection of human health and the environment, (3) visible releases are not present, regulatory authorities had been informed of any known releases from the unit, (5) the units are scheduled for closure pursuant to the TPA, (6) inspections occur and are documented on a weekly basis, and (7) problems identified will be remedied. As such, this Close Out Form represented a formal agreement between Ecology and USDOE for safe management of the HSTF until the unit could be closed and to meet the requirements of 40 CFR, Subpart J, 265.196.

With regards to the specific actions listed in this Close Out Form, USDOE and BHI have failed to do the following:

- *Cease use of the hexone tanks (the hexone tanks currently store dangerous waste returned to them from treatment of the organic material that they originally contained).*

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- *Remove sufficient waste for protection of human health and the environment (the hexone tanks currently contain inadequately designated waste which is reactive and potentially explosive).*
- *Conduct and document weekly inspections (weekly inspection of the hexone tanks does not include examination of the above ground portion of the tanks system other than reading nitrogen purge feed rotometers. Furthermore, weekly inspections are insufficient to ensure the nitrogen purge system is operating adequately due to diurnal fluctuations in barometric pressure, which in turn impacts the nitrogen purge rate).*
- *Remedy problems discovered through these inspections (weekly inspection data sheets from inspections performed in 1999 and 2000 noted loose nitrogen purge system fittings and below specification nitrogen purge rates; however, no documentation of resolution to these problems were provided in the facility's operating record).*

With regards to the requirements of 40 CFR, Subpart J, section 265.196; USDOE and BHI failed to immediately remove the hexone tanks from service and the tanks continue to store dangerous waste returned to them from treatment of the organic material that they originally contained. The operating record for the HSTF indicates that releases from the hexone tanks have most likely occurred. However, USDOE and BHI have not conducted leak tests, tank integrity examinations, soil sampling, or other examination to ensure the HSTF is not currently leaking and have failed to meet the requirements of 40 CFR, Subpart J, 265.196(e), and by reference of this regulation, 40 CFR 265.197.

In general the hexone tanks fail to meet interim status requirements for tank systems as follows:

- *WAC 173-303-070, Designation of Dangerous Waste: Distilled organic waste residues stored in the hexone tanks since 1992 have not been sampled or analyzed to accurately designate the waste a dangerous or extremely dangerous waste per the procedures set forth in WAC 173-303-070. Documentation of the hexone tank waste indicates reactive or explosive constituents may be present in the waste currently stored in the hexone tanks.*
- *WAC 173-303-283, Performance Standards: The waste stored within the hexone tanks presents a credible risk of explosion or fire; however, the tanks have not been monitored, inspected, or managed adequately to prevent endangerment of the health of employees near the facility per WAC 173-303-283(3)(i).*
- *WAC 173-303-300, General Waste Analysis: The waste stored within the hexone tanks has not been sampled and analyzed to confirm the owner or operator's knowledge of the waste sufficient to properly manage the waste per WAC 173-303-300(1)(2)(4) and (5).*
- *WAC 173-303-320, General Inspection: Weekly inspections of the HSTF have not been adequate to prevent malfunctions and deterioration of facility equipment essential for maintaining safe storage of the waste within the hexone tanks. Nitrogen purge flow is inspected weekly; however, nitrogen flow rates can vary daily due to barometric pressure changes. Some inspection data sheets record nitrogen purge rates below the minimum required rate for safe management of the waste with no indication of how ling this condition had persisted to have dropped below essential safety limits on weekly inspection data sheets.*

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Some weekly inspection data sheets indicate leaks of the nitrogen purge system and other mechanical deficiencies with the nitrogen purge system; however, there is no indication if or how these deficiencies were corrected. There is no written inspection schedule specifying inspection of tank components per WAC 173-303-640 and the inspection schedule indicates ongoing surveillance of monitoring equipment that does not exist (i.e,. liquid level monitoring in the hexone tanks).

- *WAC 173-303-330, Personnel Training: The training plan for the HSTF fails to identify all employees by position, job title, and name for each job at the HSTF and does not include an adequate written description of the introductory and continuing training required for each position at the HSTF per WAC 173-303-330(2).*
- *WAC 173-303-350, Contingency Plan and Emergency Procedures: At the time of Ecology's inspection the contingency plan maintained at the entrance to the HSTF was not the current contingency plan for the facility per WAC 173-303-350(2)&(4). Current contingency planning fails to sufficiently address known explosion and fire hazards associated with the HSTF per WAC 173-303-350(1)&(3).*
- *WAC 173-303-380, Facility Recordkeeping: The operating record for the HSTF is incomplete with some records missing. Records describing resolution of deficiencies discovered through facility inspections are incomplete or non-existent and fail to meet the requirements of WAC 173-303-380(1)(e)&(f). Recordkeeping for the HSTF fails to include accurate waste volumes within the hexone tanks, accurate shipment records of waste transferred from the hexone tanks, accurate reporting of leak tests and discharges to the soil from the hexone tanks per WAC 173-303-380(1)&(2).*
- *WAC 173-303-390, Facility Reporting: The HSTF Closure Plan has not been revised since 1992 and fails to provide current closure cost estimate information for annual reporting per WAC 173-303-390(2)(f).*
- *WAC 173-303-395, Other General Requirements: The HSTF has not been managed adequately to prevent accidental ignition or reaction of ignitable or reactive waste per WAC 173-303-395(1)(a). Documentation available for the organic wastes stored within the HSTF reveal this waste may contain potentially explosive and ignitable components. However, the waste has not been sampled or analyzed to verify whether this potentially dangerous condition persists or not. The HSTF has not been inspected annually to the requirements of WAC 173-303-395(c). The HSTF's nitrogen purge system has received only one line test examination since its installation in 1992, oxygen content within the hexone tanks is not monitored, and weekly inspections conducted at the HSTF are insufficient to ensure the nitrogen purge is operating at its specified rate.*
- *WAC 173-303-640, Tank Systems: The hexone tanks within the HSTF have not been assessed to determine their integrity per WAC 173-303-640(2). The hexone tanks are direct buried steel tanks without secondary containment or leak detection per WAC 173-303-640(4)(a), (b), (c), & (d). The hexone tanks contain potentially ignitable or explosive wastes that could cause the tanks to fail; however, the controls and practices (i.e., inspections and maintenance of the nitrogen purge system) in place at the HSTF to prevent spills from the system resulting from an explosion or fire fail to meet the requirements of WAC 173-303-640(5)(a) & (b). The hexone tanks are not provided with corrosion protection (i.e., cathodic protection) and are not managed to prevent corrosion per WAC 173-303-640(5)(a). The owner and operator of*

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the HSTF have not developed or followed an inspection schedule per WAC 173-303-640(6) and failed to adhere to or revise an agreement with Ecology to perform weekly inspections of the HSTF to meet the requirements of WAC 173-303-640(6). Weekly inspection of the HSTF conducted since at least 1996 recorded that the tank system was not leaking based on inspection of non-existent liquid level monitoring equipment. The HSTF is n unfit-for-use tank system; however, the HSTF has not been removed from service per WAC 173-303-640(7)(b).

In order to correct the violations identified in this Notice of Correction, please complete the following corrective measures within the time frames specified. Failure to correct the violations described in this letter may result in the issuance of an administrative order and/or penalties per RCW 70.105.080. A request for additional time to complete the corrective measures identified in the Notice of Correction must be in writing, describe the reasons for the request for additional time, and be received by me for consideration no later than June 9, 2000.

CORRECTIVE MEASURE:

#1) 40 CFR, Subpart J, section 265.196, Response to leaks or spills and disposition of leaking or unfit-for-use tank systems.

Immediately upon receipt of this letter, USDOE and BHI must conduct daily inspections of the HSTF nitrogen purge system rotometers. These daily inspections must document the readings as found on both HSTF rotometers and document the adjusted flow rate upon completion of each daily inspection. Each inspection must include the date and time of the inspection and signature of the inspector. Original completed and signed inspection sheets must be maintained in the HSTF's operating record and be made available to Ecology inspectors immediately upon request. Should stabilization of the HSTF tanks be postponed beyond the terms set forth in this Notice of Correction Ecology may require continuous oxygen content monitoring of the vapor space within each HSTF tank until the HSTF is stabilized.

Within thirty days (30) of receipt of this letter, USDOE and BHI must complete the following actions:

- Submit a plan and schedule to Ecology for approval for stabilization of the HSTF tanks on, or before, December 2001. Stabilization of the HSTF must include removal or deactivating the waste stored within the HSTF tanks per all applicable regulations. Should the HSTF tanks remain in place after stabilization, this plan and schedule must describe installation and implementation of monitoring of the HSTF tanks at a frequency agreeable to Ecology and sufficient to monitor organic vapors and oxygen content within the vapor space of each HSTF tank. Should the HSTF tanks remain in place after stabilization, this plan and schedule must also describe installation and implementation of monitoring for intrusion of liquids into each HSTF tank at a frequency agreeable to Ecology. This plan and schedule must include a conceptual proposal for closure of the HSTF; however, a revised closure plan for the HSTF is

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May 26, 2000
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not required at this time. All closure proposals must be coordinated with Ecology and the U. S. Environmental Protection Agency, Region 10.

- The plan and schedule described above must include submittal to Ecology by December 2000 of a written description of all costs, engineering evaluations, data quality objectives, sampling and analysis plans, and any other relevant documentation or planning required to complete stabilization of the HSTF on or before December 2001. This submittal will be subject to approval by Ecology.

- USDOE and BHI must implement monthly inspections of the above-ground portions of the HSTF to include inspection of all nitrogen purge feed lines to the HSTF tanks and all exhaust system ventilation lines from the HSTF tanks sufficient to ensure they are not leaking, that all fittings are tight, and the system is operating properly. These inspections may consist of "snoop" testing with soapy water, pressure testing of nitrogen feed lines, or other means sufficient to detect leaks from the HSTF nitrogen feed and ventilation system. Each inspection must include the date and time of the inspection and signature of the inspector. Original completed and signed inspection sheets must be maintained in HSTF's operating record and be made available to Ecology inspectors immediately upon request. These monthly inspections must be conducted until the HSTF tanks are stabilized.

Please complete and return the enclosed Certificate of Compliance to me by June 19, 2000. If you have any questions regarding this letter, please contact me at (509) 736-3031.

Sincerely,

Bob Wilson

Bob Wilson, Compliance Inspector
Nuclear Waste Program

cc: Craig Cameron, EPA
Tom Ferns, USDOE
Steven Wisness, USDOE
Moses Jaraysi, BHI
Mary Lou Blazek, OOE
Administrative Record: HSTF

Messrs. Klein and Hughes
May 26, 2000
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CERTIFICATE OF COMPLIANCE

As a legal representative of the U.S. Department of Energy, I certify to the best of my knowledge, the completion of items requested by the Washington State Department of Ecology on May 26, 2000, with regard to the inspection of the Hexone Storage and Treatment Facility located on the Hanford Site, Facility ID number WA 7890008967 as shown below.

COMPLIANCE STATUS

Corrective Measure	Date Due	Date Complete	Initials	Comments
#1	06/26/00			

Signature, USDOE-RL Representative Date

APPENDIX B

RESPONSE TO NOTICE OF CORRECTION

Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

080309

00-OSS-395

JUN 26 2000

Mr. Michael A. Wilson, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
P.O. Box 47600
Olympia, Washington 98504

RECEIVED
JUN 28 2000
BY DIS

Dear Mr. Wilson:

HEXONE STORAGE AND TREATMENT FACILITY (HSTF) STABILIZATION SCHEDULE AND RESPONSE TO CORRESPONDING NOTICE OF CORRECTION (NoC)

Reference: Ecology ltr. to K. A. Klein, RL, and M. C. Hughes, BHI, from Bob Wilson, "NOC for Stabilization of the Hexone Storage and Treatment Facility," dtd. May 26, 2000.

The U.S. Department of Energy, Richland Operations Office (RL) and Bechtel Hanford, Inc. (BHI) received the referenced NoC on May 26, 1000, requiring the following corrective measures:

1. Conducting daily inspections of the nitrogen purge system rotometers immediately upon receipt of the referenced letter;

2. submitting a Stabilization Plan and Schedule for the HSTF tanks within thirty days of receipt of the referenced letter; and

3. implementing monthly inspections of the aboveground portions of the HSTF tanks.

The first corrective measure was satisfied as required upon receipt of the referenced letter and will continue on a daily basis, except for non-regularly scheduled work days, until the nitrogen purge system is shut down through the tank stabilization process.

The second corrective measure is satisfied by the submittal of the HSTF Tank Stabilization Schedule enclosed with this letter. The schedule reflects the major activities to be completed to achieve the stabilization of these tanks by December 2001. As per the verbal agreement reached during our June 6, 2000, meeting, a detailed Stabilization Plan will be submitted for the State of Washington Department of Ecology's (Ecology's) approval by May 1, 2001. This plan will include a cost analysis, engineering evaluations, data quality objectives report, a sampling and analysis report, and a detailed schedule of the stabilization alternative activities. We are committed to the completion of this project as soon as possible and no later than December 2001. If any engineering or design issues arise that might hinder our completion by this date, we will notify you of these issues and any anticipated scheduling problems that may require a time extension.

Mr. Michael A. Wilson -2- 080309
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The third corrective measure, to conduct monthly inspections of the aboveground portions of this tank system, will be satisfied by the monthly inspection being planned for July 2000 and consecutive monthly inspections thereafter.

Although we agree with the need to complete the stabilization of the HSTF tank system, we strongly disagree with Ecology's analysis that "the HSTF currently poses a safety hazard to employees." Under the current conditions, these tanks do not pose safety hazards to employees or the public. The latest safety assessment conducted on these tanks (USQ Safety Evaluation Questions, REDOX Hexone Tanks, DIS#: 0200W-US-N0144-02, Rev. 1, Dated: April 6, 2000) confirmed the adequacy and effectiveness of the nitrogen cover system to maintain these tanks in a safe configuration. This system has been in place since 1992 with no accidents or known conditions jeopardizing the safety of our employees, the public, or the environment. We believe that this planned stabilization project will reduce the mortgage cost of managing these tanks under an active nitrogen cover, enabling us to divert this funding to more pressing environmental cleanup activities on the Hanford Site.

With regard to Ecology's decision to rescind its agreement with the provisions of the Close Out Form #16.6.2: 40.16, we believe that it is important to recognize the importance and value of upholding such an agreement and urge Ecology to reconsider this decision. Based on this agreement, we do not believe that all the interim status requirements and violations listed in the referenced letter are applicable. Although the referenced NoC letter requires changes in the inspection frequencies and scope and adds the requirement of tank stabilization, it still does not cover all the regulatory and legal aspects that were agreed to in the "Silver Letter" Close Out Form. We recommend that the referenced agreement be reinstated as modified by the new inspection and stabilization requirements identified in the referenced letter of May 26, 2000. It is our intention to comply with the new inspection requirements and those contained in the Close Out Form, with the exception of the liquid level monitoring requirement. These actions should fulfill Ecology's requirement to correct the violations described in the referenced letter.

RL and BHI are committed to comply with the corrective measures listed in your referenced letter, and will continue to ensure the safety of our employees, the public, and the environment.

If you have any questions, please contact Cliff Clark, RL, at (509) 376-9333, or Roger Landon, BHI, at (509) 372-9209.

Steve H. Wisness, Director Office of Site Services DOE Richland Operations Office	for Michael C. Hughes President Bechtel Hanford, Inc.

Enclosure:
HSTF Tank Stabilization Schedule

cc w/encl:

M. N. Jaraysi, BHI	C. E. Cameron, EPA
T. E. Logan, BHI	D. R. Sherwood, EPA
J. J. Wallace, Ecology	Environmental Portal, LMSI
R. W. Wilson, Ecology	

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HEXONE STORAGE & TREATMENT FACILITY

TANK STABILIZATION SCHEDULE

JUNE 2000

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Hexone Tanks Stabilization Schedule

The following schedule describes the activities needed to complete the stabilization of the Hexone tanks. The goal of this stabilization is to eliminate the need for an active nitrogen cover system. The stabilization work will be designed to not preclude any future closure strategies that could be designed/developed for the 200-IS-1 operable unit site.

Step 1: **Data Quality Objectives (DQO):** (July 3, 2000 to September 29, 2000)

The purpose of this DQO is to determine and agree on the data needs and goals before sampling the tank waste. It is planned to invite the regulators (Ecology and EPA) to attend this DQO to participate in setting these data requirements to satisfy both the stabilization of the tanks and to support the future closure of this TSD. This activity includes the generation of the draft DQO report, and the review and approval of the final report.

Step 2: **Sampling and Analysis Plan (SAP):** (October 2, 2000 to November 30, 2000)

After the completion of the DQO in Step 1, a SAP will be generated. This SAP will be generated in draft form and reviewed by the regulators prior to its finalization. Sampling will take place after the approval of the SAP, to provide the data needed to proceed with the stabilization of these tanks.

Step 3: **Tank Waste Sampling:** (December 4, 2000 to January 31, 2001)

The field activities to sample the waste heel will be started after a camera is lowered in both tanks to determine the physical status of the waste heel in the bottom of the tanks. This visual inspection will determine the sampling processes to be used to extract the samples from this waste. After this determination is made, actual samples will be obtained of the waste. These samples will subsequently be sent for the appropriate analyses as required by the SAP.

Step 4: **Engineering Evaluation Study:** (October, 2, 2000 to April 30, 2001)

An engineering evaluation study will be conducted to study all the viable options to stabilize the Hexone Tanks. A set of criteria that includes elements such as cost, time, and coordination with the rest of the 200-IS-1 operable unit will be applied to determine the optimum alternative/option. This engineering evaluation study will depend to a large extent on the results of the waste heel sampling and analysis. This study will also evaluate the option of achieving clean closure of this TSD to assess the related incremental cost and timing.

Step 5: **Submit Stabilization Plan to Ecology:** (May 1, 2001)

This plan will include the conclusions of the Engineering Evaluation Study, including a full description of the stabilization option chosen by the study. The plan will include the construction schedule, cost analysis, and the results of the sampling and analysis.

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<u>Step 6:</u> **Tank Stabilization:** (May 1, 2001 to December 31, 2001 (tentative))

This is the actual stabilization fieldwork to achieve stabilization of these tanks. The optimum alternative approved by the regulators will be pursued on-site and the initial commitment is to complete all fieldwork by the end of calendar year 2001. This end date might change depending on the alternative chosen and the field construction work to be completed to achieve stabilization. Any extension to this date will be provided to Ecology for approval.

TASK	2000							2001											
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Conduct DQO																			
Develop SAP																			
Perform Sampling																			
Engineering Evaluation																			
Submit IS Plan																			
Complete IS																			

APPENDIX C

COST ESTIMATES

APPENDIX C

COST ESTIMATES

Appendix A contains the cost estimate worksheets for the studied alternatives and the tank removal scenario.

Table C-1. Worksheet of Costs for Alternative #1 – Void Fill with Grout. (2 Pages)

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Provide management	Project management and field support management	Project manager	4	mhrs	120	480	
		Task lead	36		99	3,564	
		Field manager	8		107	856	
Prepare engineering documents	Design package	Design engineer	120	mhrs	91	10,920	
	Safety evaluation/USQ	Design engineer	40		91	3,640	
	Work package/task instruction	Field engineer	160		73	11,680	
	Senior review of all above	Lead engineer	24		99	2,376	
Procure materials	Specifications	Design engineer	16	mhrs	91	1,456	
	FMR	Design engineer	8		91	728	
	Coordination with procurement	Design engineer	16		91	1,456	
Mobilize to site	JHA review and walkdown	Field superintendent	8	mhrs	74	592	
		Field engineer	8		73	584	
		Pipefitter	8		62	496	
		Operator	16		61	976	
		RCT	16		77	1,232	
		IH technician	8		69	552	
		RadCon	8		77	616	
		Industrial hygiene	8		86	688	
		Design engineer	8		91	1,456	
Modify system	Modify/remove piping and components as necessary for grout pour and final configuration	Pipefitter	8	mhrs	62	496	
Pour grout into tanks	Pour grout into tanks	Field superintendent	20	mhrs	74	1,480	
		Field engineer	20		73	1,460	
		Operator	40		61	2,440	
		Pipefitter	20		62	1,240	
		RCT	40		77	3,080	
		IH technician	20		69	1,380	

Table C-1. Worksheet of Costs for Alternative #1 – Void Fill with Grout. (2 Pages)

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Materials	Grout fill material	N/A	230	cu. yd.	$160/yd	36,800	
Waste disposal	Waste disposal (removed piping)					2,000	
					TOTAL	**$94,724**	

Notes and assumptions:

[a]The Portland cement-grout mix will be supplied through a pre-qualified contractor. The mix will be delivered by transit-mixer. The driver/operator will be already familiar and trained for work on the Hanford Site.

[b]During the grout pour, the driver/operator of the truck will be supported by a crew including: 2 NPO, 1 RCT, 1 pipefitter, and 1 IH technician.

[c]The JHA review shall include: a pipefitter, operator, RadCon engineer, RCT, Industrial Hygiene, IH technician, craft field supervisor, field engineer, and design engineer.

Table C-2. Worksheet of Costs for Alternative #2 – Option 1: Continue "As-Is." (2 Pages)

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Provide management	Project management and field support management	Project manager Task lead Field manager	4 36 4	mhrs	120 99 107	480 3,564 428	
System surveillance	Daily surveillance of system operation	Operator	252	mhrs	61	15,372	
System maintenance	Periodic maintenance of system components (soap bubble test)	Operator Pipefitter RCT	48 48 48	mhrs	61 62 77	2,928 2,976 3,696	
Supply nitrogen	Change out dewars (supply of N)	Pipefitter Heavy driver	52 104	mhrs	62 51	3,224 5,304	
	Liquid N in dewar container (includes delivery)	N/A	52	count	$145/dewar	7,540	
Replace filters	Replacement of carbon (GAC) filters Replacement of HEPA filter	Field engineer Pipefitter Heavy driver RCT Field engineer Pipefitter Heavy driver RCT	8 8 8 8 4 4 4 4	mhrs	73 62 51 77 73 62 51 77	584 496 408 616 292 248 204 308	
	Carbon (GAC) filters HEPA filter	N/A	4 1	count		2,900	

Table C-2. Worksheet of Costs for Alternative #2 – Option 1: Continue "As-Is." (2 Pages)

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Waste disposal	Waste management	Waste manager	8	mhrs	62	496	
	Dispose of spent carbon filters	N/A				6,500	
					TOTAL/year	**$58,564**	
					For 10-year duration	**$585,640**	

Notes and assumptions:

[a]Costs are annual O&M expenses.

[b]Comparative costs are forecast as the total for a 10 year duration.

[c]Monthly maintenance includes a visual survey of the site and leak test (soap bubble test) of the purge system components. This task takes 4 hr/month for each craft listed (Operator, Pipefitter, RCT).

[d]Replacement of the filters occurs annually for the HEPA and semi-annually for the carbon filters. This task takes 4 hr/event for each craft listed (Field engineer, Pipefitter, Heavy driver, RCT). For the HEPA filter, this is 4 hr/year. For the carbon filters, this is 8 hr/year. The HEPA filter is a single unit. The carbon filters includes 2 filter units per change out (total of 4 items per year).

[e]The spent carbon filter units are prepared for disposal by containment in an overpack. Then the items are shipped to CWC.

[f]The daily system surveillance includes visual survey of the site and purge system components. Nitrogen supply and flow are verified as being within acceptable limits. This surveillance is performed on all normal work days (no weekends or holidays). This task accounts for 1 hr/day (252 hr/year).

[g]Nitrogen is supplied as cryogenic liquid in dewar containers. The average use is 1 dewar/week (52/year). Change out of the dewar requires a pipefitter and a teamster for 1 and 2 hr/week, respectively.

Table C-3. Worksheet of Costs for Alternative #2 – Option 2: Upgrade of Purge System. (2 Pages)

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Provide management	Project management and field support management	Project manager	4	mhrs	120	480	
		Task lead	48		99	4,752	
		F.S. manager	20		107	2,140	
Prepare engineering documents	Design package	Design engineer	160	mhrs	91	14,560	
	Drawings	Design engineer	100		91	9,100	
	Work package/task instruction	Field engineer	160		73	11,680	
	Senior review of all above	Lead engineer	24		99	2,376	
Procure materials	Specifications	Design engineer	16	mhrs	91	1,456	
	FMR	Design engineer	8		91	728	
	Coordination with procurement	Design engineer	20		91	1,820	
Modify system/install hardware	JHA review and walkdown	Operator	4	mhrs	61	244	
		Pipefitter	4		62	248	
		Instr. technician	4		66	264	
		RCT	4		77	308	
		Field engineer	4		73	392	
		Design engineer	4		91	364	
	Install instruments	Operator	36	mhrs	61	2,196	
		Pipefitter	72		62	4,464	
		Instr. technician	36		66	2,376	
		RCT	8		77	616	
		Field engineer	36		73	2,628	
	Install cable connection from sensors to control room	Electrician	80	mhrs	65	5,200	
		Instr. technician	20		66	1,320	
		Field engineer	80		73	5,840	
Start-up/test/integrate new components	Program PLC	Design engineer	36	mhrs	91	3,276	One time costs subtotal $78,828
System maintenance	Periodic maintenance of system components (soap bubble test)	Operator	8	mhrs	61	488	
		Pipefitter	8		62	496	
		RCT	8		77	616	

Table C-3. Worksheet of Costs for Alternative #2 – Option 2: Upgrade of Purge System. (2 Pages)

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Supply nitrogen	Change out dewars (supply of N)	Pipefitter	52	mhrs	62	3,224	
		Heavy driver	104		51	5,304	
	Liquid N in dewar container (includes delivery)	N/A	52	count	$145/dewar	7,540	
Replace filters	Replacement of carbon (GAC) filters	Field engineer	8	mhrs	73	584	
		Pipefitter	8		62	496	
		Heavy driver	8		51	408	
		RCT	8		77	616	
	Replacement of HEPA filter	Field engineer	4		73	292	
		Pipefitter	4		62	248	
		Heavy driver	4		51	204	
		RCT	4		77	308	
	Carbon (GAC) filters	N/A	4	count		2,900	
	HEPA filter		1				
Waste disposal	Waste management	Waste manager	8	mhrs	62	496	O&M costs $30,720/yr
	Dispose of spent carbon filters	N/A				6,500	For 10 year period $307,200
					TOTAL	**$386,028**	

Notes and assumptions:

[a]Costs are annual O&M expenses.

[b]Comparative costs are forecast as the total for a 10 year duration.

[c]Semi-annual maintenance includes a visual survey of the site and leak test (soap bubble test) of the purge system components. This task takes 4 hr/event (6 month) for each craft listed (Operator, Pipefitter, RCT).

[d]Replacement of the filters occurs annually for the HEPA and semi-annually for the carbon filters. This task takes 4 hr/event for each craft listed (Field engineer, Pipefitter, Heavy driver, RCT). For the HEPA filter, this is 4 hr/year. For the carbon filters, this is 8 hr/year. The HEPA filter is a single unit. The carbon filters includes 2 filter units per change out (total of 4 items per year).

[e]The spent carbon filter units are prepared for disposal by containment in an overpack. Then the items are shipped to CWC.

[f]Nitrogen is supplied as cryogenic liquid in dewar containers. The average use is 1 dewar/week (52/year). Change out of the dewar requires a pipefitter and a teamster for 1 and 2 hr/week, respectively.

Table C-4. Worksheet of Costs for Alternative #2 – Option 3: Intermittent Use of Purge.

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Provide management	Project management and field support management	Project manager	4	mhrs	120	480	
		Task lead	16		99	1,584	
		Field manager	4		107	428	
System maintenance	Periodic surveillance and maintenance of system components	Operator	8	mhrs	61	488	
		Pipefitter	8		62	496	
		RCT	8		77	616	
Supply nitrogen	Change out dewars (supply of N)	Pipefitter	2	mhrs	62	124	
		Heavy driver	4		51	204	
	Liquid N in dewar container (includes delivery)	N/A	2	count	$145/dewar	290	
Replace filters	Replacement of carbon (GAC) filters	Field engineer	4	mhrs	73	292	
		Pipefitter	4		62	248	
		Heavy driver	4		51	204	
		RCT	4		77	308	
	Replacement of HEPA filter	Field engineer	4		73	292	
		Pipefitter	4		62	248	
		Heavy driver	4		51	204	
		RCT	4		77	308	
	Carbon (GAC) filters HEPA filter	N/A	4 1	count		2,900	
Waste disposal	Waste management	Waste manager	4	mhrs	62	248	
	Dispose of spent carbon filters	N/A				4,000	
				TOTAL/year		**$13962**	
				For 10 year duration		**$139,620**	

Notes and assumptions:

[a]Costs are annual O&M expenses.

[b]Comparative costs are forecast as the total for a 10 year duration.

[c]Monthly maintenance includes a visual survey of the site and leak test (soap bubble test) of the purge system components. This task takes 8 hr/event for each craft listed (Operator, Pipefitter, RCT).

[d]Replacement of the filters occurs annually for both the HEPA and carbon filters. This task takes 4 hr/event for each craft listed (Field engineer, Pipefitter, Heavy driver, RCT). The carbon filter includes 2 filter units per change out. Filter replacement is conservatively postulated to be once per year for all filters.

[e]The spent carbon filter units are prepared for disposal by containment in an overpack. Then the items are shipped to CWC.

[f]Nitrogen is supplied as cryogenic liquid in dewar containers. Average use for this option is conservatively postulated to be 2 dewar/yr. Change out of the dewar requires a pipefitter and a teamster for 1 and 2 hr/event, respectively.

Table C-5. Worksheet of Costs for Tank Removal. (2 Pages)

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Provide management	Project management and field support management	Project manager	4	mhrs	120	480	
		Task lead	36		99	3,564	
		Field manager	8		107	856	
Prepare engineering documents	Design package	Design engineer	160	mhrs	91	14,560	
	Safety evaluation/USQ	Design engineer	80		91	7,280	
	Work package/task instruction	Field engineer	160		73	11,680	
	Sampling and analysis instruction					40,000	SAI would take 4 weeks to develop/issue
	Senior review of all above	Lead engineer	32		99	2,376	
Regulatory permits	Coordinate regulatory permits for tank removal	Enviro lead	24	mhrs	81	1,944	
Procure materials	FMR	Field engineer	12	mhrs	73	876	
Mobilize to site	JHA review and walkdown	Field superintendent	16	mhrs	74	1,184	
		Field engineer	16		73	1,168	
		Pipefitter	16		62	992	
		Rigger	16		62	992	
		Crane operator	16		63	108	
		RCT	16		77	1,232	
		IH technician	16		69	1,104	
		RadCon	16		77	1,232	
		Industrial hygiene	16		86	1,376	
		Design engineer	16		91	1,456	
Modify system	Remove piping and components as necessary for excavation and removal	Pipefitter	8	mhrs	62	496	
		RCT	4		77	308	
		IH technician	4		69	276	
Excavate soil	Excavate soil	Field superintendent	40	mhrs	74	2,960	Approximate volume = 1,700 cu. ft. of soil to be removed and handled
		RCT	20		77	1,232	
		IH technician	20		69	1,104	
		Heavy equip. operator	40		55	2,200	
Remove tanks	Remove tanks from excavation, then move tanks to a set-down area	Riggers	120	mhrs	62	7,440	
		Crane operator	60		63	3,780	
		Heavy driver	40		51	2,040	

Table C-5. Worksheet of Costs for Tank Removal. (2 Pages)

Activity or Item	Description	Resource	Quantity	Units	Rate	Cost	Comments
Sampling	Collect and package soil samples from under tanks Lab analysis of samples	Technician N/A				60,000	Necessary to characterize soil for subsequent action
Dismantle tanks	Build enclosure Cut open tanks then separate and package waste	* D&D worker RCT IH technician	 80 4 4	 mhrs	 49 77 69	* 3,920	
Materials		N/A				*	Components of custom built enclosure
Waste disposal	Waste management coordination		16	mhrs	62	992	
	Waste disposal	N/A				*	Removed piping/components
	Waste disposal	N/A				*	Residual sludge
					TOTAL	**$182,692**	

Notes and assumptions:

Schedule considerations:

[a]Preparatory work involved with approval and permitting by regulators (EPA and Washington State Department of Ecology) would impose a minimum of 30 days "processing time" (more realistically = 90 days).

[b]Design and activity planning is estimated to require 8 weeks lead time (concurrent to duration of permitting prep).